Economic Fluctuations and Speed of Urbanization: A Case Study of Korea, 1955-1975

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The aim of this paper is to test the hypothesis that there can exist a well-defined quantitative relationship between the economic performance of an LDC economy and its speed of urbanization. The significance of economic motives for rural-urban migration in LDC's for individual migrants is well-established. The present analysis no longer focuses on the micro-economic determinants of mobility but on the possible existence of a stable functional relationship between short-term changes in the dynamics of the national economy and the transfer of population from the farm to the non-farm sector. It is shown that the annual net out-migration rate from the farm sector in Korea can be explained very well by short-term economic fluctuations. A distributed-lag model based on the growth rate of the non-farm sector and the farm terms-of-trade explains over 80 percent of the variance of the annual migration rate over the period 1955-1975. Alternative specifications of the model show that the Todaro hypothesis of migration which has improved the analytics of the decision to migrate by an individual at a single point in time is not particularly helpful in explaining the aggregate net rural-urban migration rate over time, at least in Korea.

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TABLE OF CONTENTS

I. INTRODUCTION

II. THE DATA BASE AND THE RECORD OF THE LAST TWENTY YEARS

A. Alternative definitions of the "rural population in Korea.

B. The measurement of farm out-migration in Korea.

III. THE DETERMINANTS OF THE RURAL-URBAN LABOR TRANSFER

A. The general framework.

B. The lagged response of migration to changing economic conditions.

C. Structure of the lags between migration and its causes.

D. Further analyses of the determinants of rural-urban migration.

a. The agricultural terms of trade.

b. The real agricultural wage rate.

c. The urban-rural earnings ratio.

d. Implications of the results for the Todaro model of migration.

IV. REVIEW OF THE FINDINGS AND THEIR IMPLICATIONS

ECONOMIC FLUCTUATIONS AND SPEED OF URBANIZATION: A CASE STUDY OF KOREA 1955-1975

I. INTRODUCTION

1.1 It is now generally agreed that the processes of economic development and urbanization are interrelated. This general relationship is typically illustrated by the correlation between the rankings of countries according to their per capita GNP and according to their percentage of urbanized population; it has even been included in recent highly aggregated general models of development such as the study by Kelle, Williamson and Cheetham (1972) which has stimulated further investigations. On the other hand, there is considerable doubt about the existence of a close relationship between the short-term economic performance of an LDC economy and its speed of urbanization. Many would argue that there are too many factors involved in the decision to migrate and that attempts to establish a precise quantitative relationship between short-term economic fluctuations and rural-urban migration do not hold much promise.

1.2 To test for the possible existence of a quantitatively well-defined short-term relationship between the level of economic performance and the speed of urbanization, it is necessary to analyze country experiences on an individual basis and this paper deals with the case of South Korea. It is well known that the structure of the economy of South Korea has changed very rapidly since the end of the Korean War and has moved from a heavy dependency on agriculture for its production and small exports to a diversified industrial structure with a dynamic export sector. Over the same period the spatial distribution of population has also changed significantly, and the urban sector has grown both in absolute and relative size. The long-term association between economic growth patterns, industrialization and urbanization in Korea since 1910 has already been described (see Renaud [11], and this paper is a quantitative study of the relationship between annual economic fluctuations of the national economy and the rate of urbanization.

1.3 The paper presents an analysis of the economic determinants of the movement of population out of the farm sector to the non-farm sector in the context of a two-sector model of labor resources transfer. By focussing on the possible existence of a relatively simple quantitative relationship between national economic fluctuations (and policies) and the rate of net out-migration from the farm sector, this study could yield results of much significance for the formulation of urban policies and would also help clarify the context of employment policies. In the formulation of national economic policies, it is necessary to determine as clearly as possible the labor market conditions associated with specific sectoral planning choices: in the event of a gap between the creation of new employment and the number of new entrants into the labor force, it is important to know whether one should expect increasing levels of unemployment in urban areas. Also, given a lower rate of growth of total value-added in the farm sector than in the non-farm sector, the rate of farm out-migration has a direct impact on rural-urban income disparities, as much as it is influenced by them. From the viewpoint of urban planning, it is important to estimate the future total population transfer from the rural to the urban sector associated with selected macroeconomic targets because, in Korea, a very significant share of the growth of the population of cities is caused by net in-migration.

1.4 The analysis covers the period 1955-1975. The year 1955 is marked by the first (simplified) demographic census after the Korean War and the year 1975 the most recent one.[1/] First, the nature of the data base is discussed and the record of the last twenty years presented. Alternative definitions of the "rural" and "urban" sector in Korea are reviewed because the format of the analysis implies a close equivalence in the dynamics of population transfer between the farm and the non-farm sectors on the one hand and the rural and the urban sectors on the other. The nature of the data base for the quantitative analysis is discussed. To establish the determinants of net rural out-migration exploratory distributed-lag models are estimated using the Almon technique. The results are contrasted with equations based on the Todaro hypothesis of migration. The final section reviews the major findings and their implications for future Korean urbanization.

1.5 The main results of the quantitative analyses are that, in Korea: (1) there is a clear and direct relationship in the short-run between the annual speed of urbanization (measured by the rate of farm out-migration) and national economic fluctuations; (2) a fairly simple model based on the annual growth rate of output in the non-farm sector can explain over 80 percent of the variance of farm out-migration over the entire period; (3) the effect of growth on non-farm output is delayed and spread over three years. Current migration is most strongly affected by non-farm growth two years earlier; (4) remarkably, fluctuations in the farm output have little impact on the rate of urbanization; (5) the farm terms-of-trade have a significant effect on rural-urban migration; (6) formulation of the model along the lines suggested by the Todaro model yields negative results.

1/ With reference to the choice of the initial year, it is worth noting that in their case studies of Korea and Taiwan J.C.H. Fei and G.A. Ranis consider the period 1953-1957 as the appropriate base period to define the beginning of the "transition growth process between a long epoch of colonialism and a long epoch of modern growth" [4].

II. THE DATA BASE AND THE RECORD OF THE LAST TWENTY YEARS

A. Alternative Definitions of the "Rural" Population in Korea

2.1 It is well known that there are national differences in the characteristics which distinguish urban from rural areas and that the distinction between rural and urban population is not amenable to a single definition applicable to all countries. Each country has its own definition of what is rural and what is urban; sometimes it has more than one. Given the purpose of this paper, there are three possible measurements of the rural and urban populations of Korea.

2.2 The first two measurements are related to the distinction of population over space. The Korean system of administration distinguishes three kinds of localities: (i) the legally defined cities (Si or Shi) which numbered 35 in 1975 and have a minimum population of 50,000 people; (ii) the towns (Eub), which are places of more than 20,000 people, and (iii) the villages (Myon). In distinguishing between Si (cities) and Eub (townships, problems arise because there are Eub with more than 50,000 people which have not been promoted to the status of Si and currently about 10 Eub are being considered for such promotion. The distinction between Si and Eub is related to administrative and local finance issues: Beyond their obvious spatial significance, Eub do not have an individualized administrative existence and are merged with genuine rural population into the county (Gun) government units.

2.3 Given this three-way breakdown between cities, town and rural areas, two types of numbers can be computed for a rural-urban population breakdown. First, as is generally the case in Korea, the rural population can be defined as the "non-Si" sector and is a residual figure which includes all people not residents of a legal city (Si). It could also be defined as the "non-urban" sector, and be the residual figure after the population living in a city (Si) or in a town (Eub) has been subtracted from the national population. Both the "non-Si" and the "non-urban" figures are useful for urban planning, because they distinguish two groups of people: those living spatially concentrated in urban places and those living in scattered locations. However, the two series are bound to be misleading because they equate rural residence with farm employment when the population living in towns (Eub) is included in the rural sector or the converse. As recently as 1970, a substantial share of the population residing in towns (Eub) was working in the farm sector as seen in the employment breakdown (in 1,000) reported in the census:

	Farm Employment	Total Employment	Ratio
Cities (Si)	277	3,743	6.5%
Towns (Eub)	344	875	39.3%
Villages (Myon)	4,273	5,536	77.2%

2.4 The high percentage of farm workers in the towns explains the reluctance of the Korean government to classify these places as genuinely urban. On the other hand, one must note that 22.8 percent of the rural (Myon) labor force was classified as non-farm. From a trend comparison with earlier censuses not reported here, one could anticipate that the results of the 1975 census will reveal a sharper employment differentiation between urban and rural places (Si and Eub on the one hand and Myon on the other).

2.5 A third measurement of the rural population better related to the economics of manpower resource distribution, is implicit in the "farm population" estimated as of December 1 of every year by the Ministry of Agriculture and Fisheries.[1/] It focuses on a family's dependence on farm employment rather than on its place of residence. For the discussion of rural-urban migration which is a combination of a transfer of labor from the farm to the non-farm sector with geographical relocation this third number would be the most appropriate measurement.

2.6 These three measures of urbanization have all moved in the same direction over time as shown in Table 1. To conform with the usual format of discussion, the level of urbanization is reported in the table in terms of "city sector", "urban sector" and "non-farm sector" (columns 1, 3 and 5). The "urban sector" and "non-farm sector" indicators of urbanization are closer and appear to converge with time but the "non-farm sector" measure yields a level of urbanization consistently higher, reflecting the bias due to the inclusion of the rural non-farm population.

2.7 The data found in Table 1 provide a simple but effective illustration of where Korea stands along its long-term urbanization path. It is well known that the general path of urbanization for any country can be usefully described in very simplified terms by a logistic curve showing at any given time the share of population currently urbanized (see Figure 1). The pace of urbanization over time varies according to each country and does

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1/ An even more appropriate and possibly more accurate figure based on the same concept would be derived from the estimates of the economically active population (EAP) published by the Bureau of Statistics of the Economic Planning Board. But they could not be used for this analysis because they cover only the period 1963-1975. (See Appendix, Table 1.)

Table 1: URBANIZATION LEVEL IN KOREA ACCORDING TO THREE ALTERNATIVE MEASURES

	Rural - Urban Breakdown				Farm - Non-Farm Breakdown		
	A. Urbanization Level Based on Cities Only (Sis)		B. Urbanization Level Based on Cities and Towns (Sis+Eubs)		C. Urbanization Level Based on Farm Population		Total Population
	City Sector (Sis only) (1)	Non-City Sector (2)	Urban Sector (Sis + Eubs) (3)	Non-Urban (Myons) (4)	Non-Farm Population (5)	Farm Population (6)	(7)
	In 1,000 People						
1955	5,281	16,245	6,885	14,641	8,226	13,300	21,526
1960	6,997	17,992	9,256	15,733	10,430	14,559	24,989
1966	9,805	19,388	12,452	16,741	13,412	15,781	29,193
1970	12,929	18,506	15,783	15,652	17,003	14,432	31,435
1975/a	16,771	17,910	20,434	14,247	21,437	13,224	34,681
	Percent of Total Population						
1955	24.5	75.5	31.8	68.2	38.2	61.8	100.0
1960	28.0	72.2	37.0	63.0	41.2	58.8	100.0
1966	33.6	66.4	42.7	57.3	45.9	54.1	100.0
1970	41.1	58.9	50.2	49.8	54.1	45.9	100.0
1975/a	48.4	51.6	58.9	41.1	61.8	38.2	100.0

/a 1975 figures are based on preliminary census count.

Sources: Columns (1), (2), (3), (4) and (7), Economic Planning Board, Bureau of Statistics, Korea Statistical Yearbooks and Census.
Column (5) = (7) - (6).
Column (6), unadjusted farm population at the end of the calendar year reported by the Ministry of Agriculture and Fisheries. These figures have been adjusted for the analysis.

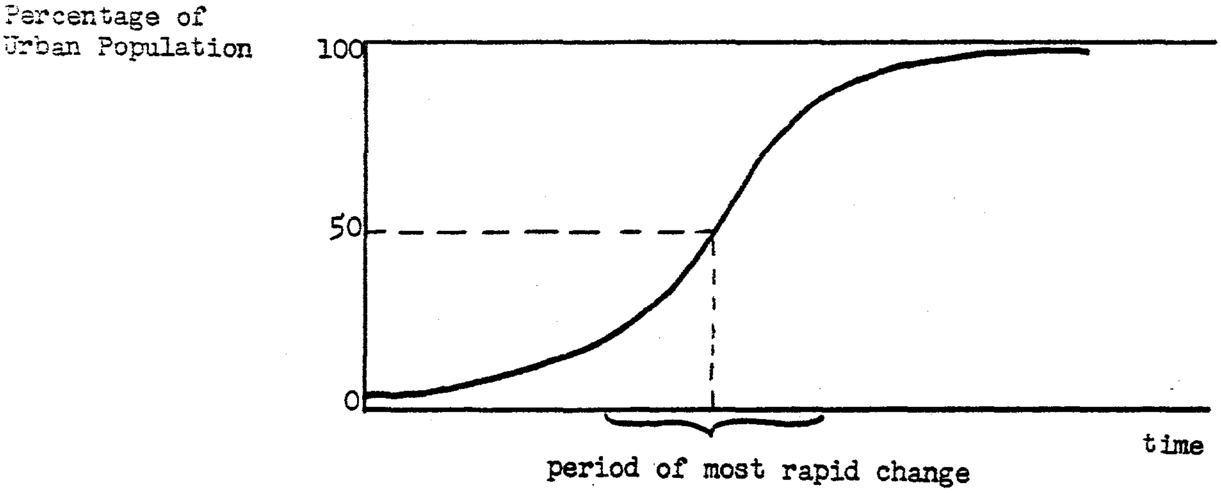

FIGURE 1: Long-Term Urbanization Trends as Represented by the Logistic Curve.

not follow rigorously the path defined by the theoretical curve but the region of the curve around the 50 percent level of urbanization containing the inflexion point is associated with the period of most rapid urbanization. Table 1 shows that Korea has been urbanizing very rapidly over the last 20 years and crossed the mid-point of urbanization around year 1970. This suggests that the rate of urbanization in Korea has recently reached levels that are not likely to be observed again over significant lengths of time and that future intersectoral population transfers, while still very significant, may be less dramatic. The analysis which follows should determine the validity of this hypothesis.[1/]

B. The Measurement of Farm Out-Migration in Korea

2.8 There are no official data on the annual volume of rural out-migration flows for Korea but indirect estimates of net farm out-migration can be derived from data on the farm population and estimates of annual natural population growth rates. The proper way of measuring a migration rate is to take the ratio of the population that actually moved over the potentially mobile one.

2.9 Given the following:

F_t: observed farm population at year t,

$\hat{F}_t$: the expected farm population,

g: the natural population growth rate of the farm population,

m: the rate of net out-migration,

1/ For more discussions of empirical uses of the logistic curve refer to the United Nations manual on projections of rural and urban population [15], especially Chapter V and Annex I.

we have:

$$\hat{F}_{t+1} = (1 + g)\ F_t$$

$$m = \frac{\hat{F}_{t+1} - F_{t+1}}{\hat{F}_{t+1}} = \frac{(1+g)F_t - F_{t+1}}{(1+g)F_t}$$

$$F_{t+1} = (1-m)\ \hat{F}_{t+1}$$

and the relationship between two consecutive actual farm populations is necessarily:

$$F_{t+1} = (1-m)\ (1+g)\ F_t$$

In other words, to estimate the rate of out-migration the observed farm population is compared with the population that should have been observed given the current crude population growth rate, had no migration taken place. This estimation procedure is known as the vital statistics method (see [14]).

2.10 The annual statistical yearbooks of EPB provide annual estimates of the natural population growth rate but no estimates specific to the farm population. To the extent that the farm natural population growth rate is higher than the non-farm rate, estimates of the net out-migration rate derived on the basis of the total population growth rate have a downward bias. The magnitude of the bias depends on the fertility and mortality rates specific to each sector. An additional problem is that the population growth rate of 1.67 percent reported in the yearbooks over the entire period 1970-1975 is inconsistent with the 1975 preliminary census results, and larger estimates consistent with the 1975 results were calculated as reported in Table 2.

Table 2: ESTIMATION OF NET OUT-MIGRATION BASED ON UNADJUSTED MAF DATA (VITAL STATISTICS METHOD)

	Reported Farm Population	Total Population Growth Rate	Expected Farm Population	Net Farm Out-Migration	Rate of Out-Migration
1952	12,856	-	-	-	-
1953	13,151	-	-	-	-
1954	13,170	-	-	-	-
1955	13,300	-	-	-	-
1956	13,445	2.96%	-	-	-
1957	13,592	2.97	13,858	266	1.96%
1958	13,750	2.98	14,001	251	1.83
1959	14,126	2.99	14,166	40	.28
1960	14,559	3.00	14,555	-4	-.03
1961	14,509	2.96	15,002	493	3.40
1962	15,097	2.88	14,944	-152	-1.01
1963	15,266	2.72	15,538	272	1.78
1964	15,553	2.45	15,684	131	0.84
1965	15,812	2.28	15,938	126	0.80
1966	15,781	2.12	16,176	395	2.50
1967	16,078	2.08	16,119	41	.26
1968	15,908	2.01	16,415	507	3.19
1969	15,589	1.85	16,231	642	4.12
1970	14,432	1.81	15,880	1,488	10.31
1971	14,712	1.81	14,695	-16	-.03
1972	14,677	1.85/a	14,980	303	2.13
1973	14,645	1.89/a	14,951	297	2.14
1974	13,459	1.84/a	14,914	1,455	9.94
1975	13,244	1.89/a	13,706	462	3.44
1976	12,785	-	13,494	709	5.36

/a Population growth rate estimates calculated to be consistent with 1970-75 intercensal population growth and different from EPB estimates.

Note: The rapid decline in farm population after 1973 reported by MAF is in contradiction with the small upward trend reported by EPB (see Appendix, Table 1).

Sources: Reported Farm Population: Ministry of Agriculture and Fisheries Statistical Yearbooks.
Population Growth Rates, EPB Statistical Yearbooks.

2.11 The farm population estimates of the Ministry of Agriculture and Fisheries (MAF) are available as far back as year 1952 [1]. But, given that the armistice for the Korea War took place in 1953 and that the first post-war population census was taken in 1955, the period 1955-1975 is the most appropriate for the analysis. In a first round of analysis, estimates of net out-migration flows and rates were computed. The data base was found to be internally consistent except around the census years 1960, 1966 and 1970 when MAF seems to have arbitrarily adjusted its estimates to better conform with census results, even though the methodology of the census has been quite different. The results are unrealistic estimates for these selected years, such as a very large net out-migration rate for the year 1970 of 10.31% of the farm population, implying that 1.5 million people moved and a negative out-migration rate the following year (see Table 2). Similarly, the figures for 1973-76 are seriously underestimated. The farm population estimates derived from the more accurate EPB labor surveys would have provided a useful alternative data base, but the series cover only the period since 1963, which is too short for the analysis; for comparison with the data used, these estimates are presented in Appendix 1. To correct for the discrepancies around census years, the MAF results have been adjusted by graphical smoothing of the farm population as illustrated in Figure 2. The resulting adjusted data on the farm population are presented in Table 3.

2.12 The migration flows and rates derived from the adjusted MAF data are presented graphically in Figures 3 and 4. These two figures show that, after a period of significant farm net out-migration following the end of the Korean War, the rural-urban transfer of population declined rapidly to a trickle around 1959-1960. After the Military Revolution of 1961 and the

FIGURE 2:

ESTIMATED FARM POPULATION IN SOUTH KOREA

(Source : December 1 estimates, Ministry of Agriculture and Forestry).

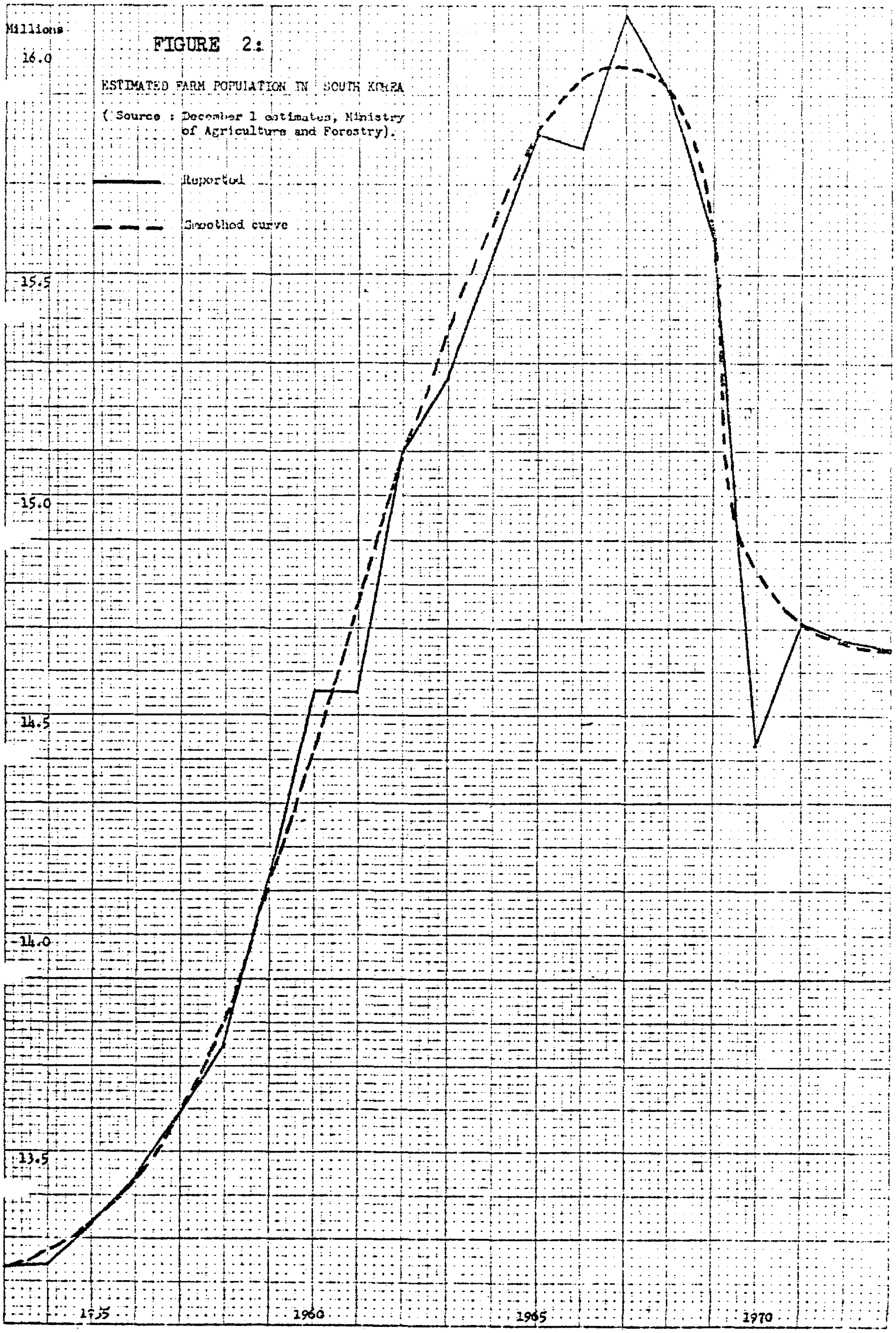

Table 3: ADJUSTED DATA ON FARM POPULATION AND NET OUT-MIGRATION ESTIMATES

	Adjusted Farm Population* (1,000)	National Population Growth Rate	Expected Farm Population	Out-Migration Flows	Out-Migration Rate
1955	13,300	2.98	13,558	268	1.98
1956	13,440	2.96	13,702	262	1.91
1957	13,590	2.97	13,838	248	1.79
1958	13,790	2.98	13,994	204	1.46
1959	14,200	2.99	14,201	1	0.01
1960	14,460	3.00	14,625	165	1.13
1961	14,780	2.96	14,894	114	0.77
1962	15,100	2.88	15,217	117	0.77
1963	15,400	2.72	15,535	135	0.87
1964	15,610	2.45	15,819	209	1.32
1965	15,810	2.28	15,992	182	1.14
1966	15,920	2.12	16,170	250	1.55
1967	15,960	2.08	16,258	298	1.83
1968	15,910	2.01	16,292	382	2.34
1969	15,600	1.85	16,230	630	3.88
1970	14,850	1.81	15,889	689	4.34
1971	14,710	1.81	15,121	411	2.72
1972	14,680	1.85	15,978	299	1.87
1973	14,650	1.89	14,954	304	2.03
1974	14,620	1.84	14,929	309	2.07
1975	14,600	1.89	14,906	306	2.05

Source: *Adjusted from Table 2 and Figure 2.

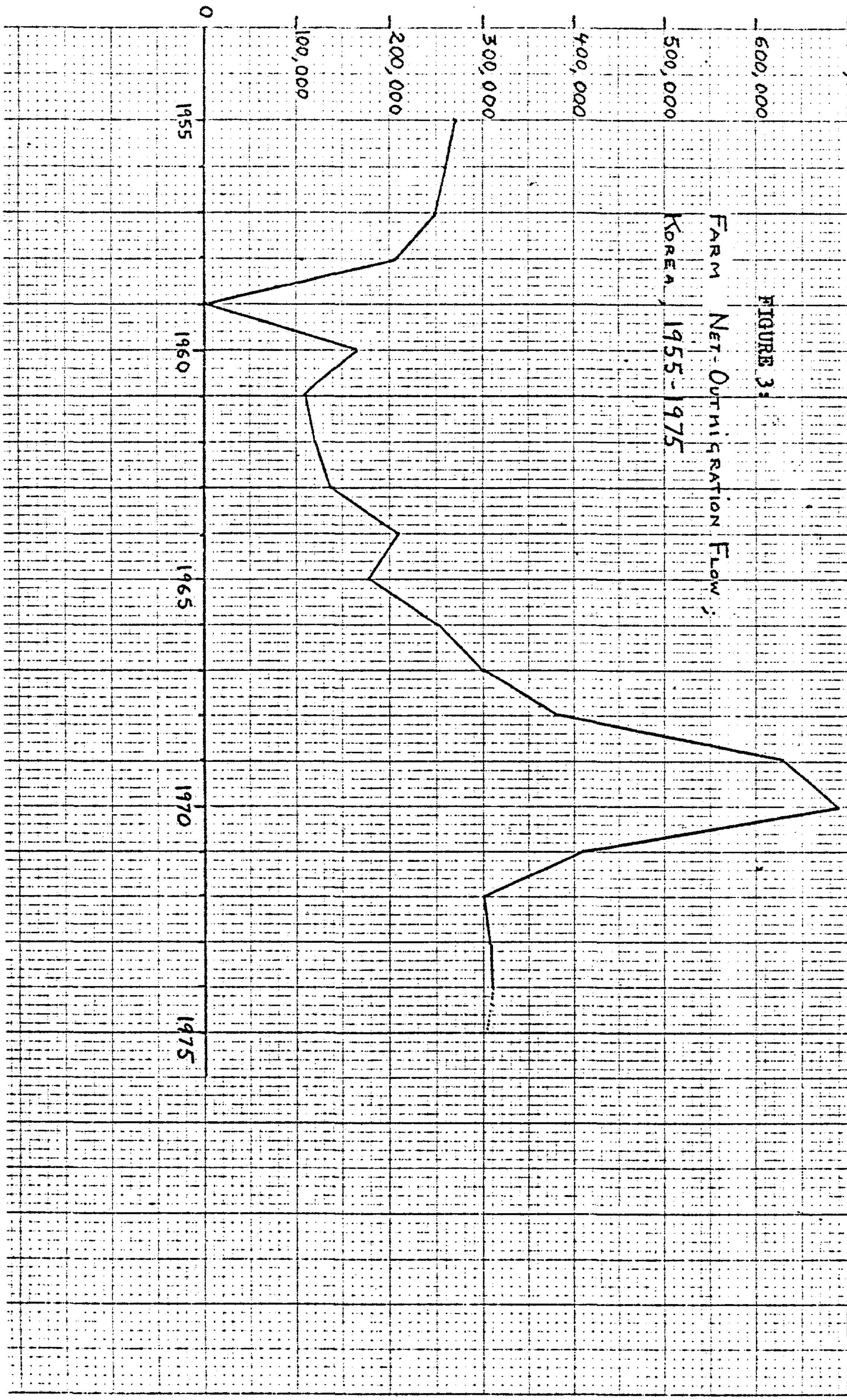

FIGURE 3: FARM NET OUTMIGRATION FLOW; KOREA, 1955-1975

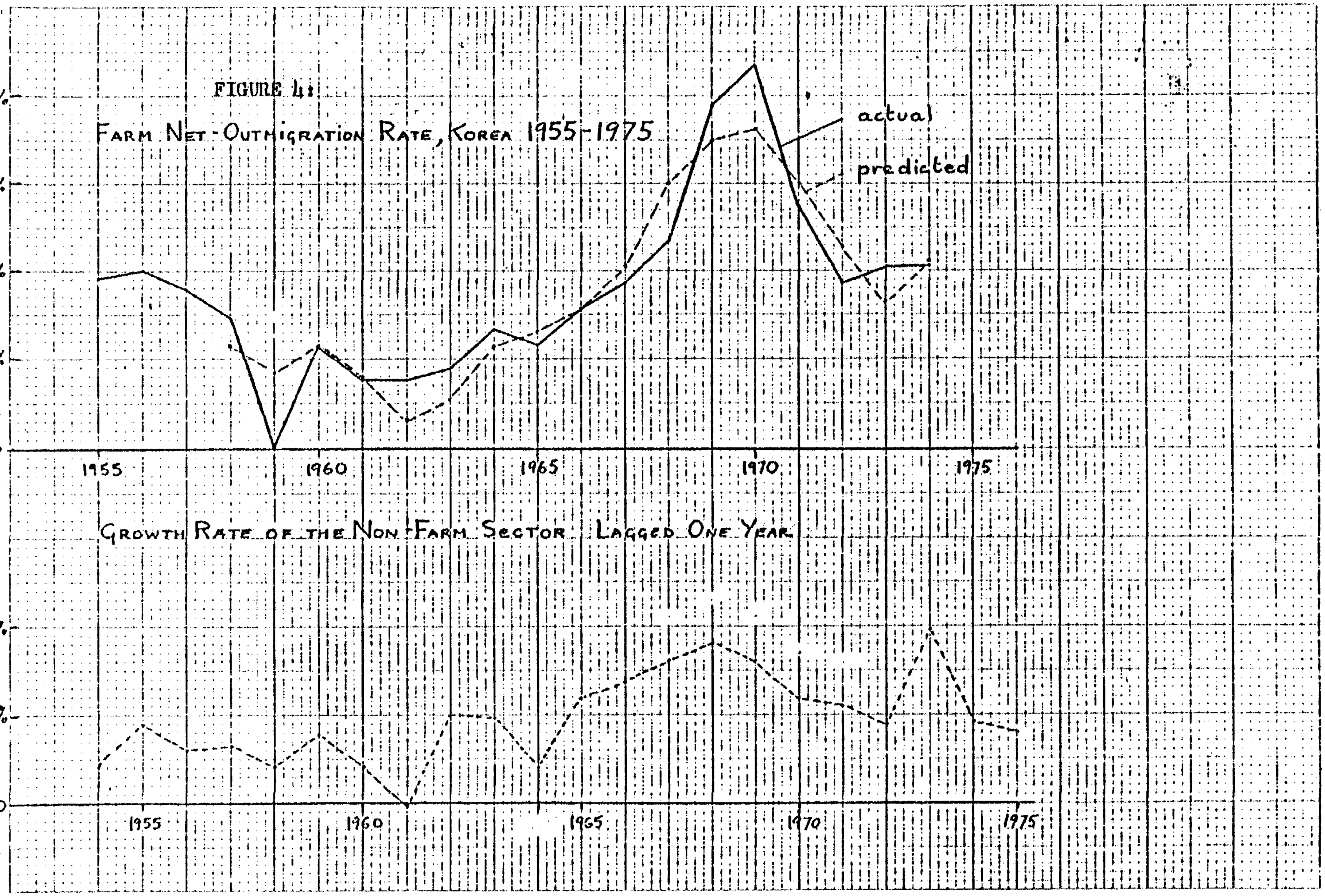
FIGURE 4:
FARM NET-OUTMIGRATION RATE, KOREA 1955-1975
actual
predicted
4%
3%
2%
1%
0
1955
1960
1965
1970
1975
GROWTH RATE OF THE NON-FARM SECTOR LAGGED ONE YEAR
20%
10%
0
1955
1960
1965
1970
1975

ensuing economic reforms, both yearly net migration flows and rates have accelerated steadily to reach extremely high levels between 1968 and 1971. Since that time, there appears to be a levelling of the out-flow to around 300,000. people a year for a net out-migration rate of about 2 percent from the remaining farm population. The peak in the rural-urban transfer of population around the year 1970 is in agreement with the broad hypothesis derived earlier from the use of the logistic curve to represent long-term urbanization trends. It remains to reconfirm in the quantitative analysis that this historically high migration rate observed around 1970 both in terms of absolute numbers of migrants and in terms of migration rates is unlikely to be observed again, particularly the massive transfers recorded for 1969 and 1970.

III. THE DETERMINANTS OF THE RURAL URBAN LABOR TRANSFER

A. The General Framework

3.1 The evidence on the significance of economic motives for rural-urban migration and the selection of destination by individual migrants is well established for LDCs (see L. Yap [16]). A variety of surveys also exist for Korea which describe the motivation of migrants (see Choe [3], Kwon et. al. [7], Lee and Barringer [8], Moon [9], Yoon [17], Kim and Renaud [6]). An econometric analysis of interprovincial migration flows shows also very clearly that population mobility in Korea represents a rational and, in the aggregate, an economically efficient pattern of resource reallocation in the sense that net migration flows are moving from regions of low to regions of high labor returns (Renaud [12]). In the context of the present paper the focus is no longer on the microeconomic determinants of mobility but on the possible existence of a stable functional relationship between short-term changes in the dynamics of the national economy and the transfer of population from the rural to the urban sector. In other words, the aim is to establish the extent to which changes in the performance of the Korean economy can explain quantitatively the observed changes in the speed of urbanization against the contrary view that, in an LDC, short-term relationship between urbanization and economic development is just a coincidence.

3.2 The rate of transfer of population from the farm to the non-farm sector should be explainable by three groups of factors: expected economic opportunities in the non-farm sector compared to those in the farm sector, the demographic structure of the farm population and, finally, sociological factors. Given the purpose of establishing quantitatively the relationship between macroeconomic changes and rural-urban migration, the analysis focuses on economic and demographic factors only. This choice is also justified[1/] by a previous microanalysis of migration. (Renaud [12].)

3.3 As far as demographic factors are concerned, the studies previously mentioned show that mobility is the greatest between the ages of 14 and 35 in Korea. Thus, for a given size of the total farm population, the rate of out-migration should be higher when the share of the farm population between 14 and 35 is large. Because the 14 to 35 age group is the most mobile, continuing high migration will lead to a significant ageing of the farm population and, under conditions of stable cohort-specific migration rates, the overall farm net out-migration rate will tend to decline, everything being equal. Unfortunately, acceptable yearly estimates of the age structure of the farm population are not available. Tentative analyses based on crude estimates were unsuccessful and are not reported here. On the other hand, the ageing of the farm labor force since 1963 is easy to show on the basis of the EPB surveys of the economically active population covering the farm population (see Table 4). This rapid ageing is in sharp contrast with the younger age structure of the non-farm economically active population and supports the view that one source of declining farm out-migration rates in the coming years will be the ageing farm demographic structure.

1/ Analysis of inter-provincial migration flows show that economic variables determine these flows in direction and magnitude.

Table 4: WEIGHTED AVERAGE AGE OF THE ECONOMICALLY ACTIVE POPULATION IN KOREA 1963-1975

	Farm Average	Non-Farm Average
1963	35.4	35.2
1964	35.3	35.1
1965	35.2	35.3
1966	35.6	35.3
1967	36.1	35.1
1968	36.8	35.4
1969	36.7	35.2
1970	36.5	34.8
1971	37.2	34.6
1972	37.2	35.1
1973	37.3	34.2
1974	38.1	34.2
1975	39.5	34.1

Sources: 1963-1969 Annual Report on Economically Active Population 1971, Economic Planning Board, Bureau of Statistics.

1970-1975 Monthly Statistics of Korea, December 1976, Economic Planning Board, Bureau of Statistics.

Weighted Average based on mid-point age of each cohort and on 62.5 years of age for cohort 60 years and older.

3.4 With respect to economic factors, three types of variables can be used to describe the relative attractiveness of the non-farm sector compared to the farm sector: (a) relative earnings per worker in the farm and the non-farm sectors; (b) the evolution of the terms-of-trade experienced by farmers; (c) fluctuations and growth in the farm and non-farm sectors, reflected by the annual rates of growth of the farm and non-farm components of GNP as proxy variables for the yearly volume of employment available in each sector. Variables (a) and (c) embody the Todaro migration hypothesis.

B. <u>The Lagged Response of Migration to Changing Economic Conditions</u>

3.5 The recorded net annual out-migration flows from farms represent the results of the variety of individual moves that took place during the year from rural to urban areas and in the opposite direction. All the surveys mentioned earlier yield consistent findings to the effect that, in Korea, the decision to migrate is based over-whelmingly on the expectation of better employment opportunities for their children. Thus for an individual, and equally for a household, migration between two different jobs and two different locations (the most common combined move) should, in theory, be a function of the net expected present value of the investment made in the move. In other words, the decision-maker will compare the discounted stream of expected earnings for the household unit in its present situation with the discounted stream of anticipated earnings in the new location, net of the cost of relocating. This general formulation has been verified for Korea (Renaud [12]); however, we cannot expect a perfect instantaneous adjustment to changing economic conditions because of incomplete information, persistence of habits and institutional constraints.

In any period, a discrepancy will exist between the actual net out-migration rate and the theoretically desirable one, because the expected conditions leading to the decision to migrate will differ from the realized conditions at that time.

3.6 One of the simplest quantitative representations of this migration pattern is to say that, in a given year, the probability of migration Y_t (which can be aggregated into the net out-migration rate) is related to a certain expected level of economic opportunities, X_t^* for that year:

(1) $$Y_t = \alpha + \beta X_t^* + u_t$$

where u_t is a random variable with zero mean. Since X_t^* is not directly observable, one can postulate that the change in expectation this year will be proportional to the difference between the expected level of economic opportunities last year X_{t-1}^* and the actual value X_{t-1}. This yields the relationship:

(2) $$X_t^* - X_{t-1}^* = (1 - \lambda)(X_t - X_{t-1}^*)$$

or equivalently:

(3) $$X_t^* = (1 - \lambda) X_t + \lambda X_{t-1}^*$$

with $$0 \leqslant \lambda \leqslant 1$$

The substitution of the explicit form of X_t^* in equation (3) into equation (1) can be shown to yield the following equation:

(4) $$Y_t = \alpha + \beta (1 - \lambda)(X_t + \lambda X_{t-1} + \lambda^2 X_{t-2} + \ldots\ldots) + u_t$$

This equation is one representation of the hypothesis that in any given year we expect the probability of migration not to be influenced only by the current economic conditions and that farmers who are migrating to the cities form their own opinion of the future on the basis of observed current and past economic conditions.

C. Structure of the Lags Between Migration and its Cause

3.7 The model of migration represented by equation (4) is one of the simplest model of adaptative expectation. It results in a lag-structure whereby the impact of economic conditions declines continuously in a geometric progression away from current conditions. Using the Koyck transformation, this type of model can be estimated in the form:

$$Y_t = \alpha(1 - \lambda) + \beta(1 - \lambda) X_t + \lambda Y_{t-1} + v_t \qquad (5)$$

where $v_t = u_t - \lambda u_{t-1}$

However, the Koyck distributed-lag formulation, in addition to imposing a fixed patterns on the impact of previous economic conditions present significant statistical difficulties in empirical estimation. Therefore, an unrestricted lag structure estimated by the method of polynomials (the Almon technique) has been used as an alternative model.1/

3.8 A polynomial lag structure of the Almon type allows testing of several hypotheses concerning the response of migration to changing economic conditions. First, it does not assume arbitrarily that the relative impact of the preceeding years is declining continually as in the Koyck lag structure. By allowing the distribution weights of each individual year to have some form of inverted -V lag distribution, it allows a test of the hypothesis that current conditions have an impact which is to some degree smaller than that of earlier years. In addition, the number of periods before the weight can be assumed to be zero is finite, an assumption consistent with the idea that only a small number of years is necessary for migrants to realize their decision to move. The estimating equation of a polynomial lag model is of the form:

1/ The analysis using a Koyck transformation of the geometric distributed-lag was performed. The statistical results confirmed that the effect of past economic conditions does not decline smoothly with time in the case of Korean migration.

(6) $$Y_t = \alpha + \beta \, (W_o X_t + W_1 X_{t-1} + \ldots + W_m X_{t-m}) + u_t$$

where the weight from W_o to W_m lies on a polynomial curve of a prespecified degree. For instance, in a fourth-degree polynomial curve, the weights would be of the form:

(7) $$W_i = \lambda_o + \lambda_1 i + \lambda_2 i^2 + \lambda_3 i^3 + \lambda_4 i^4$$

where i refers to the year of the weight. Replacing the explicit form of the weights in the original equation yields an estimating equation which embodies the specific hypotheses made for the lag structure and at the same time does not suffer from statistical shortcomings similar to those of the Koyck procedure. In practice the length of the polynomial is related to the empirical structure of the lags.

3.9 The Almon technique has been used to explore the influence on the annual net-migration rate of several types of variables, used singly or in combination. First, the net farm out-migration rate was regressed on the rural-urban earnings ratio as suggested by the micro-economic theory of migration. Second, it was tested against the growth rates of value-added in the farm and non-farm sectors, used as combined proxies for the total number of jobs available in each sector and the average level of earnings offered. Third, the terms-of-trade experienced by the farm sector were used to test the hypothesis that, given the constantly higher average level of earnings in the non-farm sector, net out-migration would be heavily influenced by employment and earnings conditions in the farm sector. Distributed-lag models using relative urban-rural earnings and the terms-of-trade experienced by the farm sector yield very mediocre results. On the other hand, models based on the growth rates of the farm and non-farm sector yield significant results.[1/]

1/ In order to save space, they are the only results reported here, but the others are available from author. The analyses were performed with the TSP computing package.

3.10 The first formulation tests the two hypotheses that the effect of growth on migration is spread over several years and that fluctuations in both the farm and the non-farm sectors have a significant impact. The following equation was estimated:

(8) $OUTMR = f\ (GRNF_{o},\ GRNF_{-1},\ GRNF_{-2},\ GRFM_{o},\ GRFM_{-1},\ GRFM_{-2})$

where: OUTMR = net farm out-migration rate;

GRNF = growth rate of value-added in non-farm sector in the current and the past two years;

GRFM = growth rate of value-added in the farm sector similarly structured.

3.11 The estimation of this equation yields three important joint results. First, it confirms that the impact of economic fluctuations on rural-urban migration is spread over several years. Second, it shows, rather unexpectedly, that the impact of economic fluctuations within the farm sector of the decision to migrate is not directly significant. Third, it also indicates that economic conditions prevailing during the current year in the non-farm sector have little or no effect on the contemporaneous rate of migration. This first equation (not fully reported in the paper) can explain almost 80 percent of the variance of the net farm out-migration rate. The values of the distributed-lag weights in that equation are:

	GRNF		GRFM	
	Weight	T-Value	Weight	T-Value
Lag 0 (current year)	-.382	-.09	-0.135	-.036
Lag -1	6.55	1.44	-1.345	-.032
Lag -2	17.89	3.66	0.924	.258
Mean Lag	1.76	4.87	-0.090	.019

Table 5: FARM AND NON-FARM AVERAGE MONTHLY EARNINGS PER WORKER

	Monthly Earnings per Worker in Mining and Manufacturing	Agric. Receipts (Excluding Non-farm receipts)	Farm Workers Per Household	Monthly Earnings per Farm Worker	Monthly Earnings in Manufacturing (per worker)	GNP Deflator 1970=100	Monthly Earnings in Manufacturing Deflated by GNP Deflator
1957	2,640	45,700	3.44	1,107	2,030	19.49	
1958	2,700	45,940	3.44	1,113	2,170	19.41	11,180
1959	3,220	37,580	3.42	916	2,350	19.93	11,791
1960	3,300	50,030	3.00	1,390	2,330	21.80	10,688
1961	3,780	60,460	3.20	1,574	2,610	25.08	10,407
1962	4,030	73,420	3.33	1,837	2,780	28.57	9,730
1963	4,670	100,925	3.20	2,628	3,180	36.77	8,648
1964	5,620	128,072	3.27	3,263	3,880	48.55	7,992
1965	7,130	115,991	3.15	3.068	4,600	52.64	8,739
1966	8,410	131,407	3.12	3,509	5,420	60.05	9,026
1967	10,990	150,995	3.12	4,032	6,640	68.53	9,689
1968	12,240	177,083	3.00	4,918	8,400	76.56	10,972
1969	15,100	214,617	2.96	6,042	11,270	86.71	12,997
1970	17,490	248,064	2.91	7,103	14,560	100.00	14,561
1971	20,790	356,567	2.92	10,176	17,349	111.48	15,562
1972	21,229	427,994	2.98	11,968	20,104	127.66	15,748
1973	23,267	480,263	2.93	13,659	22,330	139.91	15,960
1974	31,552	664,441	2.86	19,360	30,209	177.20	17,048

Source: Economic Statistical Yearbooks, Bank of Korea and Economic Planning Board, various years.

Table 6: GNP AT CONSTANT 1970 PRICES: TOTAL, FARM AND NON-FARM, SOUTH KOREA 1953 - 1975

	GNP	Farm	Non-Farm	Total	Farm	Non-Farm
	level (in Billion Wons)			Rate of Change (in percentage points)		
1953	843.5	397.4	446.1			
1954	898.2	427.6	462.6	5.5	7.6	3.7
1955	938.4	499.5	499.6	5.4	2.6	8.0
1956	942.2	412.5	529.7	0.4	-6.0	6.0
1957	1,014.4	450.1	564.3	7.7	9.1	6.5
1958	1,067.2	478.1	589.0	5.2	6.2	4.4
1959	1.108.3	472.5	635.8	3.9	-1.2	7.9
1960	1.129.7	466.6	663.2	1.9	-1.2	4.3
1961	1,184.5	522.2	662.3	4.8	11.9	0.1
1962	1,221.0	492.2	728.8	3.1	-5.7	10.1
1963	1,328.3	532.0	796.3	8.8	8.1	9.3
1964	1,442.0	614.6	827.4	8.6	15.5	3.9
1965	1,529.7	602.7	927.1	6.1	-1.9	12.0
1966	1,719.2	667.9	1,051.3	12.4	10.8	13.4
1967	1,853.0	634.8	1,218.2	7.8	-5.0	15.9
1968	2,087.1	650.1	1,437.0	12.6	2.4	18.0
1969	2,400.5	731.5	1,669.0	15.0	12.5	16.1
1970	2,589.3	724.6	1,864.7	7.9	-.8	11.7
1971	2,826.8	748.5	2,078.4	9.2	3.3	11.5
1972	3,023.6	760.9	2,262.7	7.0	1.7	8.9
1973	3,522.8	803.0	2,719.8	16.5	5.5	20.2
1974	3,825.5	847.6	2,977.9	8.6	5.6	9.5
1975	4,107.7	900.0	3,207.8	7.4	6.2	7.7

Source: Bank of Korea, Statistical Economic Yearbook (annual).

Both the structural coefficients and the weight values for GRFM are statistically insignificant. In the case of growth rate of value-added in the non-farm sector, the results are statistically strongly significant except for the ambiguous results concerning growth in the current year. The weights of this first exploratory estimation of the distributed-lag model of migration indicates that the lag structure may involve more than two years. For confirmation we estimated models involving up to six years with and without including the term GRNF related to growth in the current year. Four of the more interesting results are reported in Table 7.

3.12 In equations estimated with five growth rates the parameters of the current growth rate GRNF are always insignificant. The two most significant parameters are consistently those for the growth rate last year and two years ago ($GRNF_{-1}$ and $GRNF_{-2}$) (see equations 1 to 4 in Table 7). When using the Almon technique the structure of the lag may be left unconstrained or not: two alternative forms of lag are investigated by changing the degree of the polynomial for the weights. In equations (1) and (3) the lag structure is unimodal and the weights are non-negative. In the second group of equations (2) and (4) the weights of $GRNF_{-3}$ and $GRNF_{-4}$ are negative suggesting a sine shaped structure of the weights, with $GRNF_{-3}$ having very small and non-significant parameters. Because there is no obvious theoretical reason for the effect of past growth to skip intermediate years these preliminary findings obtained can be used to simplify the quantitative analysis.

3.13 The Almon technique is a rather complex procedure and the preliminary results obtained by using it have significantly clarified the patterns of migration response to economic changes over time. Because these patterns having been found simple, the analysis can be further refined with standard OLS regression analysis. The results presented in Table 7, part B confirm that the

Table 7: ALTERNATIVE MODELS EXPLAINING THE FARM OUT-MIGRATION RATE

	A. Almon Lag Models				B. Ordinary Least Squares Models (OLS)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Constant	−0.5968	−.2198	−.5354	−.1543	−.406	−.349	–	1.319	–	1.898	−.3446
	(−1.50)	(−.63)	(−1.51)	(−.51)	(−.35)	(−.31)	–	(0.83)	–	(1.32)	(−1.07)
GRNF	0.0127	0.0098	–	–	1.225	–	–	–	–	–	–
	(0.40)	(0.43)	–	–	(0.42)	–	–	–	–	–	–
$GRNF_{-1}$	0.0915	0.0908	0.0952	0.0933	0.0846	0.0882	0.0747	0.0874	0.0837	0.0866	0.0853
	(2.86)	(5.31)	(3.22)	(6.05)	(2.75)	(3.07)	(2.85)	(2.94)	(2.88)	(2.53)	(2.98)
$GRNF_{-2}$	0.0828	0.0720	0.0826	0.0733	0.1257	0.1294	0.1133	0.1397	0.1392	0.0972	0.0828
	(2.62)	(3.81)	(2.72)	(4.10)	(3.41)	(4.05)	(3.95)	(4.31)	(4.38)	(3.35)	(2.73)
$GRNF_{-3}$	0.0623	−0.0025	0.0679	−0.0021	–	–	–	–	–	0.0588	0.0531
	(1.49)	(−0.12)	(1.78)	(−.11)	–	–	–	–	–	(1.88)	(1.38)
$GRNF_{-4}$	−0.013	−0.0525	−0.0147	−0.0541	–	–	–	–	–	–	–
	(−0.34)	(−1.96)	−0.40	(−2.13)	–	–	–	–	–	–	–
TOT_{-1}	–	–	–	–	–	–	–	−1.546	−.404	−2.4578	–
	–	–	–	–	–	–	–	(−1.085)	(1.07)	(−1.88)	–
R^2	.8253	.8998	.8228	.8977	.799	.796	Irrelevant	.829	Irrelevant	.848	.778
$\bar{R}^2$	.7459	.8441	.7637	.8568	.753	.767	–	.778	–	.771	.732
S.E.	.5560	.4138	.5364	.3967	.549	.533	–	.511	–	.479	.340
Mean Lag	1.659	.65	.754	−.310	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Polynomial Degree	5	7	5	7	–	–	–	–	–	–	–

t-ratios in parentheses.

Equations including the terms-of-trade variable cover the period 1960–1975 only, other equations cover 1955–1975.

current GRNF is not statistically significant. Forcing the equation through the origin does not improve the results. On the other hand, the introduction of the terms-of-trade experienced by farmers a year earlier improves the analysis (equation 8, Table 7).

3.14 Finally, the use of three lagged values of GRNF jointly with the TOT variable has been estimated. The parameters of the lagged variables in equation (10) are very similar to those they have in the equation (1) where the Almon technique has been used. Equation (10) is to be preferred to equation (1) because all its parameters are significant at a much higher level. Its adjusted R^2 is higher and the standard error of the estimate smaller. Altogether, equation (10) can explain 85 percent of the variance of the yearly net out-migration rate. If we were to scale up to one the weights of the parameters of the growth rate of the non-farm (GRNF) over time, the lag structure would be as follows:

$GRNF$:	0	(0)
$GRNF_{-1}$:	35.7	(.0866)
$GRNF_{-2}$:	40.1	(.0972)
$GRNF_{-3}$:	24.2	(.0588)
$GRNF_{-4}$:	0	(0)
Total effect of GRNF :	100.00	(.2426)

3.15 The stability of the parameters between equation (1) using the Almon technique and equation (10) using ordinary least-squares indicates that serial correlation among the independent variables is not a problem.1/

1/ The actual correlation matrix for equation (10) is:

$GRNF_{-1}$	1.000			
$GRNF_{-2}$	0.205	1.000		
$GRNF_{-3}$	0.305	0.471	1.000	
TOT_{-1}	0.138	0.195	0.143	1.000

D. Further Analysis of the Determinants of Rural-Urban Migration

3.16 The very strong statistical explanatory power of the lagged growth rate of the non-farm sector is an important result whose policy significance will be examined further. However, it was surprising to find that variables such as urban-rural relative earnings per worker did not have a greater effect at the aggregate level, when the relative earnings ratio is so significant in explaning individual migration. This suggests the hypothesis that equation in Table 7 could be interpreted as the reduced-form equation of an equation system where the relative farm to non-farm earnings ratio is itself strongly influenced by the growth rate of the non-farm sector. In other words, the relative-earnings ratio or the farm terms-of-trade variables may be contributing little to the statistical explanation of the net farm out-migration rate because they are themselves influenced by variable GRNF. To clarify this situation, we investigate the relationship between changes in the growth rate of value-added in the non-farm sector and selected economic indicators of labor market conditions in both the farm and non-farm sectors, which are expected to have a significant impact on the rural-urban transfer of labor, namely: (1) the farm terms-of-trade; (2) the agricultural wage rate and (3) the ratio of earnings per worker in manufacturing and agriculture.

(a) The Agricultural Terms-of-Trade

3.17 The indicator used to describe the terms-of-trade (TOT) experienced by farmers consists of the ratio of the index of prices received and prices paid by farmers compiled by the National Agricultural Cooperative Federation. The TOT ratio reported in Table 8 uses 1970 for the reference year, but this does not imply that in 1970 the farm TOT were in some sense neutral or consistent with the opportunity cost of farm inputs and outputs. The only

Table 8 : INDEX OF PRICES PAID, PRICES RECEIVED BY FARMERS AND TERMS OF TRADE

Year	Prices Received (1970 = 100)	Prices Paid (1970 = 100)	Terms of Trade (2) ÷ (3)
(1)	(2)	(3)	(4)
1960	20.9	26.6	.7857
1961	24.6	28.7	.8571
1962	27.1	31.8	.8572
1963	40.1	35.3	1.1360
1964	50.2	48.8	1.0287
1965	52.2	51.8	1.0077
1966	55.4	58.1	.9535
1967	63.5	65.8	.9650
1968	74.3	78.8	.9429
1969	84.8	86.8	.9701
1970	100.0	100.0	1.0000
1971	121.0	114.4	1.2577
1972	147.9	130.5	1.1333
1973	164.2	143.1	1.1474
1974	215.6	192.5	1.1200
1975	267.6	237.9	1.1248

Note: A change of base year from 1970 to 1965 would make the terms of trade index slightly less favorable to farmers but their evolution from year to year would be unaffected.

Source: Monthly Statistics of Korea, Economic Planning Board, various issues.

information provided in the series relates to TOT fluctuations from year to year. These fluctuations appear to be consistent with the pattern of rural-urban migration. However, three alternative migration equations attempting to use the TOT for the explanation of the net out-migration rate are unsuccessful whether the TOT are used in current or lagged form. It is only in the equation already discussed (Equation 10) that the TOT variable has a significant impact and reduces the standard error of the estimate substantially. For instance, the following equation was estimated:

$$\underset{}{OUTMR} = \underset{(3.787)}{.880} \; \underset{(4.268)}{-.561TOT_{-1}} + \underset{(3.969)}{1.782TOT_{-2}} \quad R^2 = .022$$

Other attempts to justify variations in the rate of rural-urban migration solely on the basis of changes in the farm terms-of-trade are unproductive in the case of Korea. Neither is the attempt to establish a relationship between TOT and current and/or lagged values of GRNF successful. The best result is:

$$TOT = \underset{(.029)}{.453} \; - \underset{(.497)}{7.34} \; GRNF_{-2} \qquad R^2 = .166, \quad \bar{R}^2 = .089$$

It suggests only that the TOT have been negatively correlated with past expansion in the non-farm sector, but basically there is little statistical relationship between TOT and GRNF.

(b) <u>The Real Agricultural Wage Rate (RAGW)</u>

3.18 Another important indicator of employment opportunities in the farm sector is the real agricultural wage rate for hired workers (reported in [10]). In their analysis of Korean development patterns Fei and Ranis have paid much attention to this variable to identify the possible existence of a turning-point in the Korean economy. One reason is that this variable is a much more sensitive indicator of short-term conditions in labor markets in the farm <u>and</u> non-farm sectors than real farm earnings per worker (RFARMY) as could be seen, for instance, in 1974 when RAGW and RFARMY moved in different directions. The lack of a close relationship between the wage for hired workers and farm conditions can be established even more clearly by comparing two equations. The first one shows that there is little relationship between fluctuations in the <u>farm</u> sector and the RAGW:

$$\underset{(1.190)}{RAGW = 11.261} \quad \underset{(34.179)}{- 8.397\ GRFM} \quad \underset{(10.865)}{- 14.352\ GRFM_{-1}} \quad \underset{(9.350)}{+ 6.171\ GRFM_{-2}}$$

with: $R^2 = .201$ and $\bar{R}^2 = -.065$

where GRFM is the rate of growth of value-added in the farm sector. On the other hand, RAGW has a significant relationship with economic fluctuations in the <u>non-farm</u> sector:

$$RAGW = 55.021 \quad \underset{(68.80)}{+126.03\ GRNF_{-1}} \quad \underset{(76.96)}{+ 156.78\ GRNF_{-2}}$$

with: $R^2 = .57$ and $\bar{R}^2 = .49$

These two equations indicate that the real agricultural wage is a useful indicator of slackness in the demand for labor in the non-farm sector and confirm the earlier findings of this paper that rural-urban migration in Korea is best explained by the performance of the non-farm sector.

(c) <u>The Urban-Rural Earnings Ratio (ERATIO)</u>

3.19 This ratio is calculated on the basis of average earnings per farm family workers (FARMY) and the earnings per worker in the manufacturing sector (WRMF). It is found at the aggregate level that rural-urban migration is poorly explained directly by variable ERATIO. However, the rural-urban earnings ratio itself is fairly well explained by past growth in the non-farm sector as shown by the following two equations:

$$OUTMR = 1.909 + 0.749\ ERATIO_{-1} - 0.813\ ERATIO_{-2}$$
$$(1.886)\quad (1.095)\qquad\qquad (1.090)$$

with: $R^2 = .059$ and $\bar{R}^2$ negative

while on the other hand we have:

$$ERATIO = .997 + 2.928\ GRNF_{-2}$$
$$(.007)\quad (.839)$$

with: $R^2 = .480$ and $\bar{R}^2 = .443$ DW = 1.89

The very delayed response of the earnings ratio to growth in the non-farm sector is confirmed by the analysis of the manufacturing wage deflated by the GNP deflator (WRMF):

$$WRMF = 8082.24 + 14{,}319.91\ GRNF_{-1} + 24{,}048.40\ GRNF_{-2}$$
$$(13{,}659)\qquad\qquad (13{,}211)$$

with: $R^2 = .349$ and $\bar{R}^2 = .256$

where only the coefficient of $GRNF_{-2}$ is statistically significant.

(d) Implications of the Results for the Todaro Model of Migration

3.20 These further explorations of the determinants of rural-urban migration show that the basic Todaro hypothesis according to which individual migration decisions are based on relative expected earnings in the rural and the urban sector is not particularly helpful to explain the transfer of population from the rural to the urban sector over time. In Korea the single most important variable is the growth rate of the non-farm sector: Together with the lagged farm terms-of-trade it constitutes a much more powerful predictor of net rural out-migration over time than Todaro-type explanatory variables. It is interesting to note that fluctuations in the growth rate of the farm sector are of no significance. In Korea the realized growth targets for the non-farm sector are the major determinants of the speed of urbanization.

IV. REVIEW OF THE FINDINGS, THEIR IMPLICATIONS

(a) Main Findings

4.1 The analyses presented in this paper provide a stringent test of the possibility of explaining short-term changes in rural-urban migration in Korea because they explain changes in the annual rate of rural-urban migration through the fluctuations in the rate of growth of value-added in the non-farm sector, instead of relating migration flows to the total size of value-added in the non-farm sector. Despite the imperfections of the data base, the results of the quantitative analyses provide strong support for the following statements.

(1) The rate of net out-migration from the farm sector in Korea can be well defined by the fluctuations of the non-farm sector, and there is a clear and direct relationship in the short-run between the annual speed of urbanization and national economic fluctuations. Because the analysis has relied only on the growth rates of value-added in the farm and the non-farm sectors, the macro-economic forces which determine the growth rate of total value-added in the non-farm sector itself have not been detailed. Several econometric analyses exist which tackle this separate problem of analysing the determinants of economic growth in Korea.

(2) A fairly simple model structure based on the growth rate of the non-farm sector can explain over 80 percent of the variance of the net farm out-migration rate over the entire period 1955-1975. The exact percentage depends on the specification of the equation selected.

(3) The effect of growth in value-added in the non-farm sector on rural-urban migration is not instantaneous. Rather, it is a delayed response based on what happened over the three previous years. This delayed response

is presumed to be due in part to the delayed adjustment of the wage level in the non-farm sector to economic growth; imperfect information and the costs of migrating would also contribute to the explanation.

(4) Remarkably, the rate of growth of value-added in the farm sector, in current or distributed-lag form, has no statistical significance for the explanation of the out-migration rate. In other words, the "pull" factor in rural out-migration dominates completely in Korea. The fact that the wage level for hired farm labor (RAGW) is best explained by fluctuations in the non-farm sector also emphasizes that over the period it has been possible to draw labor out of the farm sector without affecting farm productivity.

(5) The farm terms-of-trade contribute significantly, if in a limited quantitative way, to the explanation of the annual rate of rural-urban migration.

(b) <u>The Outlook for Future Rural-Urban Migration</u>

4.2 From the viewpoint of long-term urbanization in Korea the analysis shows that during the year 1970, the volume of out-migration from the rural sector reached a historical high both in absolute numbers and in terms of migration rates. This finding is in agreement with the general notion implicit in the logistic curve that the speed of urbanization should be reaching a peak when the percentage of population urbanized is in the vicinity of the 50 percent level.

4.3 To confirm that recent massive rural-urban transfers of population in a single year such as 1970 are unlikely to occur again in the future, it remains to perform a simple numerical evaluation of the migration prospects under reasonable assumptions concerning the future economic growth of Korea in the next five years. This sensitivity analysis rests on the outlook for (1) the rate of natural increase of the national population, RNI; (2) the planned growth rate of value-added in the non-farm sector, GRNF, and (3) the possible terms-of-trade experienced by the farm sector.

4.4 A general expression for the observed net growth rate of the farm population can be easily deduced from the vital statistics method used for the estimation of the net farm out-migration rate. To lighten the presentation, the following symbols are used:

- net farm out-migration OUTMR = m
- rate of natural increase RNI = g
- observed net growth rate of farm population = f

by definition we had:

$$m = \frac{F(1+g) - F_{+1}}{F\ (1+g)} = 1 - \frac{1}{(1+g)} \left(\frac{F_{+1}}{F} \right)$$

and since:

$$f = \frac{F_{+1} - F}{F}$$

we can write:

$$m = 1 - \frac{1 + f}{1 + g}$$

and

$$f = g(1-m)-m$$

where percentage rates are converted to their decimal format such as g = .019.

4.5 It is more difficult to derive a general formula for the net rate of growth of the urban sector u on the basis of g and m because the eventual value of u is dependent on the current allocation of population between the rural and the urban sector, i.e., on the current level of urbanization. In terms of observed growth rates, for a given year, we have the identity:

$$g = f\,w + u\,(1-w)$$

where w is the proportion of population currently in the rural sector and has a value which is shifting over the years. For instance, using the estimate for the farm population in 1975, the value of w for that year is w_o = .421 and for the following year it will become a smaller fraction defined by the expression:

$$w = \left(\frac{1 + f}{1 + g}\right) w_o$$

Having two equations with the two unknowns u and w we can obtain an explicit expression for u in terms of the rate of natural increase g and rate of migration m. However, this expression is not unvariant from year to year and it is much simpler to derive a general expression for the share of the farm sector in the total population and then to derive from it the observed rate of growth of the urban sector between the base year (zero) and any given year (n). Thus:

$$w_n = \left[\frac{(1 + f)}{1 + g}\right]^n w_o$$

Obviously, the level of urbanization, i.e., the percentage of population urbanized is $(1-w_n)$.

4.6 To perform a sensitivity analysis on the outlook for future Korean urban growth, reasonable orders of magnitude for the key variables are needed. Preliminary estimates provided by the Bureau of Statistics of the Economic Planning Board are that the projected intercensal population growth rate for the period 1975-1980 will be on the order of RNI=1.7. Longer term projections beyond 1980 anticipate a slight increase to RNI=1.9. These estimates of national population growth rate are necessary to calculate the relative growth and absolute size of both the rural and the urban sector associated with various values of the net out-migration rate OUTMR.

4.7 Based on the historical record, three values can be used: GRNF = 5, 10 or 15 percent. Given the current dynamics of the Korean economy, the value GRNF = 5 is likely to be an underestimate, as it implies relative stagnation of the economy. The value GRNF = 10 was observed over the entire decade of the sixties; it is also the value chosen as a target for the fourth five year plan. Given that the target value of GRNF = 10 may be conservative in the Korean context, the achievable rate of GRNF = 15 is also used. Further sensitivity analyses on GRNF could be performed easily.

4.8 The outlook on the terms-of-trade experienced by the farm sector is harder to specify. Since 1970, an improvement in the TOT has been observed in favor of farmers. However, the improvement may have been the result of short-term cyclical economic conditions and of government pricing policies, particularly concerning fertilizers, which could shift markedly. The outlook for the value of TOT for a sensitivity analysis could be simplified by using two alternatives: (a) levelling near the 1974 level, TOT = 1.15; (b) stabilization at the lower level of 1970, TOT = 1.00.

4.9 There are two equations available for sensitivity analysis: one excluding the TOT variable but estimated over the full period 1955-1975 (column 11, Table 7) and the other including the TOT but estimated only over the shorter period 1960-1975 (column 10, Table 7). The comparison of results obtained for the period 1975-1980 on the basis of the two equations is presented in Table 9. This table reports the value derived for the four unknowns u, f, u and (1-w) implied by given values of RNI, TOT and GRNF. By looking at the first series of results for the three values of GRNF assuming that RNI = 1.7 and TOT 1.0, it can be seen that the results yielded by the two equations are fairly similar.

Table 9: SENSITIVITY ANALYSIS OF FUTURE URBANIZATION RATES IN KOREA

	Equation 11 (1955-75)			Equation 10 (1960-75)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
GRNF =	5	10	15	5	10	15
RNI = 1.7 (1) m	.76	1.87	2.97	.65	1.87	3.08
TOT = 1.0 (2) f	.93	-.20	-1.32	1.04	-.20	-1.45
(3) u	2.40	3.05	3.69	2.40	3.05	3.69
(4) (1-w)	.60	.62	.64	.60	.62	.64
RNI = 1.7 (1) m	.74	1.83	2.97	.28	1.67	2.80
TOT = 1.15 (2) f	.93	-.20	-1.32	1.42	0.17	-1.05
(3) u	2.40	3.05	3.69	2.06	2.73	3.37
(4) (1-w)	.60	.62	.64	.59	.61	.63
RNI = 1.9 (1) m	.74	1.83	2.92	.65	1.87	3.20
TOT = 1.0 (2) f	1.13	-.01	-1.13	1.24	0.01	-1.24
(3) u	2.59	2.92	3.57	2.51	3.25	3.88
(4) (1-w)	.60	.61	.63	.59	.62	.64
RNI = 1.9 (1) m	.74	1.83	2.92	.28	1.50	2.80
TOT = 1.15 (2) f	1.13	-.00	-1.13	1.61	0.37	-.85
(3) u	2.59	2.92	3.57	2.26	2.92	3.57
(4) (1-w)	.60	.61	.63	.59	.61	.63

GRNF = Growth rate of value added in the non-farm sector.
RNI = Rate of natural increase of the Korean population.
TOT = Terms-of-trade experienced by the farm sector.

The rates presented in the rows refer to the following results:

(1) Net farm out-migration rate m = constant.
(2) Net growth rate of the farm population f = constant.
(3) Net growth rate of the urban population computed over a five-year period.
(4) Level of urbanization after a five-year period with $(1-w_o)$ = .579 in 1975.

Then, one should prefer the equation based on the shorter time period because it includes the TOT variable. The results reported in columns 5, 6 and 7 of Table 9 show that the influence of the farm terms-of-trade is greater than would have been anticipated from the inspection of the original equation. In the case of the plan objective (GRNF = 10 percent), the terms-of-trade variable acts as a switching device and makes the difference between a slow decline or a slow increase of the farm population. In the case of a faster non-farm growth rate (GRNF = 15), the decline of the farm population would be very substantial.1/

4.10 To illustrate further the results of Table 9, the annual results based on the assumptions of GRNF = 15, RNI = 1.7 and TOT = 1.0 are presented in Table 10. The set of assumptions chosen yields a slow decline in the farm population; but, of the four million increase in the urban population, 1.8 million, or 45 percent, will be due to a steady rural-urban migration flow of approximately 0.3 million of migrants per year. This picture understates the likely future of urbanization because the past Korean record shows that the rate of growth of value-added in the non-farm sector will be greater than 10 percent over significant periods of time generating a faster pace of urbanization which would not be compensated for in times of economic slowdown, the process being assymetrical. In fact, the value of GRNF would have to fall below 2.5 percent over at least three consecutive years to yield a zero migration rate, a situation which has not occured over the 25 year period studied, and has not even been approached over the last fifteen years.

1/ It must be kept in mind that a large negative growth rate of the farm population does not imply disappearance of that group, because the migration rate applies to a diminishing base from year to year leading to continuously smaller out-migration flows.

Table 10: PROJECTIONS OF URBANIZATION PATTERNS BASED ON THE FOURTH PLAN ASSUMPTIONS

	Total Population	Farm Population	Migration Flow	Non-Farm (Urban) Population
1975	34,681	14,600*	-	20,081
76	35,270	14,551	301	20,619
77	35,870	14,500	300	21,370
78	36,480	14,456	299	22,024
79	37,100	14,408	298	22,692
80	37,731	14,361	297	23,370
81	38,372	14,313	296	24,059

* Estimated value.

Assumptions: RNI = 1.7, GPNF = 10.0, TOT = 1.0.

On the other hand, the combination of a very high rate of natural increase together with a high rate of growth of value-added in the non-farm sector and a large farm population cannot be recreated to yield urbanization of the same magnitude as in the intercensal period 1966-1970.

(c) Migration and Rural-Urban Income Disparities

4.11 Finally, it is possible to analyse the impact of rural-urban migration on the likely course of rural-urban income disparities. As seen earlier, the rate of growth of value-added in the farm sector has practically no direct impact on migration. Assuming a value of GRFM of 5 percent, if rural-urban migration is high the rate of growth of per capita output will be faster than the growth rate of total value-added in the farm sector. On the other hand, large values of non-farm output will induce faster migration which affects negatively per capita output in the non-farm sector. From this we then calculate the order of magnitude of GRNF which will generate the smallest difference in the growth of per capita output between the two sectors. The results of the exercise presented in Table 11 show that, for a given growth rate of output in farm output, the faster the growth of the non-farm sector the greater the widening of disparities, a not very surprising result. More interesting is the result that a high rate of natural population increase has a negative influence on the rural-urban disparities, particularly when the growth of the non-farm sector is slow.

Table 11: IMPACT OF URBANIZATION ON THE RURAL-URBAN DIFFERENTIAL IN PER CAPITA OUTPUT

Conditions	Per Capita Growth Rate of Output	GRNF=5	GRNF=10	GRNF=15
RNI = 1.7	(1) Non-Farm	2.60	6.95	11.31
TOT = 1.0	(2) Farm	4.21	5.33	6.45
GRFM= 5.0	(3) Difference	-1.61	1.62	4.86
RNI = 1.9	(4) Non-Farm	2.74	6.75	11.12
TOT = 1.0	(5) Farm	2.49	5.13	6.24
GRFM= 5.0	(6) Difference	.25	1.62	4.88

* Based on the 1960-74 equation.

Table 1: ESTIMATES OF THE FARM POPULATION DERIVED FROM THE EPB LABOR FORCE SURVEYS (in 1,000)

Year	Total Population (mid-year estimates)	Share of Population (14 and over)	Farm Population (14 and over)	Total Farm Population (3) ÷ (2)	Expected Farm Population	Net Out-Migration Flow	Net Out-Migration Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1963	26,987	.5812	9,030	15,537	-	-	-
1964	27,678	.5906	9,370	15,865	15,960	95	0.60
1965	28,327	.5626	9,353	16,625	16,254	-371	-2.28
1966	28,933	.5657	9,006	15,920	17,004	1,084	6.37
1967	29,541	.5675	8,843	15,582	16,258	676	4.17
1968	30,171	.5690	8,739	15,359	15,906	547	3.44
1969	30,738	.5738	8,601	14,990	15,668	678	4.33
1970	31,286	.5834	8,540	14,638	15,267	629	4.12
1971	31,844	.5962	8,283	13,893	14,903	1,010	6.70
1972	32,425	.6083	8,447	13,886	14,144	258	1.82
1973	33,011	.6176	8,744	14,158	14,143	-15	-0.11
1974	33,722	.6271	8,984	14,326	14,426	100	0.69
1975	34,383	.6194	9,054	14,617	14,604	-13	-0.09

Notes: (1) The estimation method of monthly statistics on economically active population was changed for all years after 1972 from the simple unbiased estimate method to the ratio estimate method.

(2) The mild upward trend in farm population since 1973 reported by the EPB-BDS data contradicts the data reported by the Ministry of Agriculture and Fisheries.

Source: Economic Planning Board, Bureau of Statistics.

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